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(54) Cylinder Head Gasket for Internal Combustion Engines

(57) A gasket is injection moulded from synthetic plastics material and includes combustion chamber openings 2, cooling water openings 3 and holes for coolant and fixing bolts. Openings 2 may be provided with an encircling bead 4*a*. Regions 9 and 10 are of fluoropolymer while the less highly stressed region 11 is of normal butyl rubber. In alternative embodiments the gasket may have metal or fabric reinforcement embedded therein.

FIG. 5

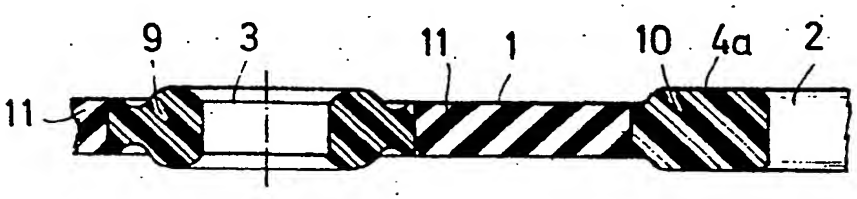

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FIG. 1.

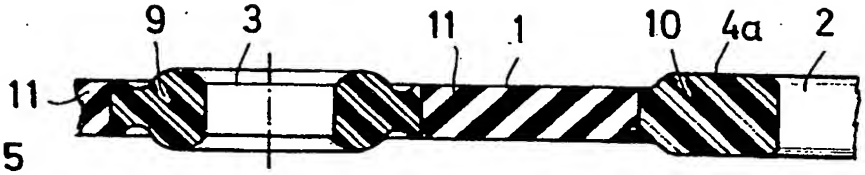

FIG. 5

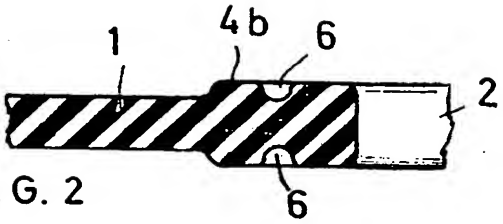

FIG. 2

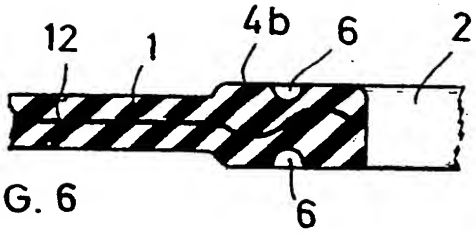

FIG. 6

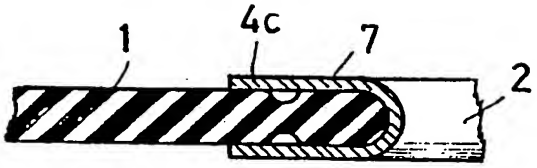

FIG. 3

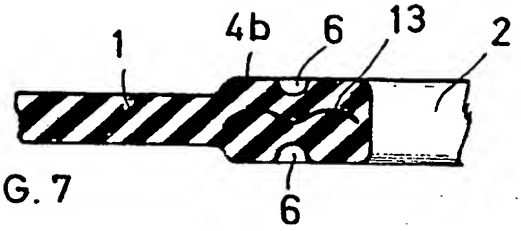

FIG. 7

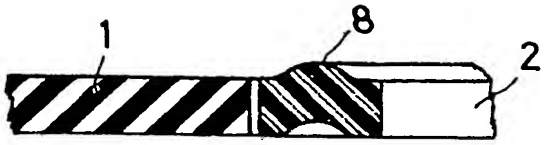

FIG. 4

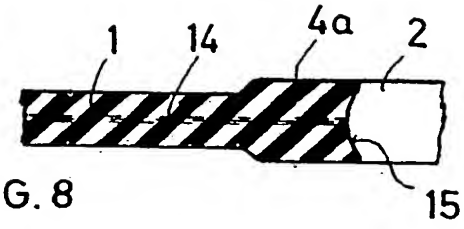

FIG. 8

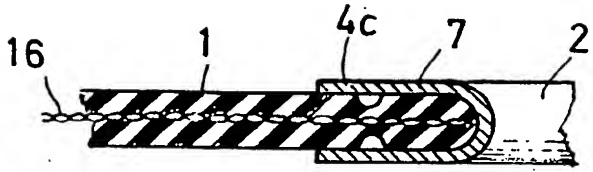

FIG. 9

SPECIFICATION

Cylinder Head Gasket for Internal Combustion Engines

The invention relates to a cylinder head gasket for internal combustion engines consisting of a sheet or plate of soft material with through openings for the combustion chambers, the lubricating oil, the coolant and the fixing bolts.

Depending upon application, cylinder head gaskets for internal combustion engines consist in practice either of metal sheets or of metal-reinforced asbestos fibre sheets. In the processes employed heretofore, the contours of the finished cylinder head gasket, with the through openings for the combustion chambers, the fixing bolts, the coolant and the lubricant are punched out of the finished metal sheet or asbestos fibre sheet in a following step. Depending upon the use of the finished cylinder head gasket, its sealing surfaces are frequently provided with profile-like projections. In the case of metal cylinder head gaskets, these projections are produced in another step by embossing beads or corrugations in the desired zones. If necessary, these profile-like projections may also consist of superimposed layers on the sealing surfaces, which are preferably printed on to cylinder head gaskets of soft material by a screen printing process.

In practice, the process of manufacture described has proved satisfactory and many cylinder head gaskets are made in this way. Of course, manufacture of this kind is comparatively expensive and complicated, because on the one hand a three-stage production process is relatively tedious and costly and on the other hand about 60 to 80% of the sealing plate or gasket material is generally removed from the sealing plate by the punching operation and the waste can be used at the outside as scrap. As a result, there is an unfavourable occurrence of relatively high material costs in this production process.

It is therefore the problem of the present invention to provide a cylinder head gasket which can be produced simply and cheaply with as low a consumption of material as possible, while also abandoning the use of asbestos.

According to the invention, this problem is solved by means of a cylinder head gasket consisting essentially of polymer and produced by a moulding process known from the plastics or rubber art. In this process, the raw and plastic synthetic or rubber compositions are fed into moulds with the appropriate contours and are hardened or vulcanized, as the case may be, therein under the action of pressure and heat. As such moulding processes there are used, above all, the C, TM and IM processes, but preferably, in accordance with the invention, the IM process also called the injection moulding process is used, since by this process the cylinder head gasket according to the invention can be produced particularly well in mass production.

The moulding tool is shaped in accordance with the contours of the gasket to be made. Consequently, no material is employed for the through openings. Moreover, the mould can be provided with recesses on one or both sides corresponding to the profiled projections, of the sealing surfaces. These profiled projections may either be arranged on the cylinder head gasket according to the invention above all so that they extend in annular form on one or both sides around the through openings, or, in accordance with the specific structural conditions of the sealing surfaces of the engine block and the cylinder head, profilings may be distributed over the remaining surface area of the gasket.

Readily injectable thermoplastics or types of rubber with good resistance to changes of temperature and chamicals are chiefly used as materials. Since these materials are relatively costly, only a defined zone around, for example, the combustion chamber or liquid openings may, if necessary, consist of these materials, while the remaining surface areas are produced from normal types of rubber or plastic. Both materials or, if necessary, even more materials, may then be injected together into the mould and vulcanized.

Generally, in the operation of engines, cylinder head gaskets are subjected to stress by elevated temperatures above 140° to a maximum of 200°C only at the combustion chamber openings in a zone about 3 to 5 mm deep, while the remaining surface areas are subjected to temperatures only up to a maximum of about 100°C. It is therefore frequently also sufficient to employ a cheaper material for the cylinder head gasket which pyrolizes at the edges of the combustion chamber openings at the high temperatures above 140°C, so that the product hardened like coke which is formed in the process after a running/in time forms an adequate protection against the hot combustible gases of the engine.

If necessary, the combustion chamber openings may be edged or enclosed in addition, but in principle a very straight sealing edge at the combustion chamber is particularly advantageous, since in this way a free space in which oil carbon residues could accumulate is avoided. If necessary, therefore, this sealing edge may be given a concave shape, so that when the gasket is fitted the edge is deformed into a straight line under the applied sealing pressure.

Moreover, for reinforcement, the gaskets may contain embedded plastics or metal plates. These may extend over the entire extent of the sealing surfaces or else only over parts thereof, such as in particular around the through openings or the other areas of intensified sealing pressure. If necessary, parts of the embedded plates may also be profiled or corrugated and superimposed layers or coatings are also possible instead of a reinforcing insert. In addition, the reinforcing inserts may have hollow spaces which are closed up when the gasket is fitted, so that a certain additional spring-back resilience is created in the gasket.

Furthermore, the embedded reinforcements may also consist of non-woven fabrics or the plastic or rubber may contain incorporated fibres for reinforcement.

Consequently, the cylinder head gasket according to the invention provides a gasket of sufficient strength simply and with a saving of costs in a single working operation with the optimum low consumption of material. Moreover, it is to be expected that the use of asbestos as a soft material will be restricted in the future because of its harmful effect on health. Plastics or rubber materials are used in the cylinder head gasket according to the invention, however, and asbestos is completely replaced. The lower compressibility and spring-back resilience of the solid plastics or rubber sheets is compensated either by the profile-like projections or by the suitably embedded reinforcing plates. The profile-like projections and the embedded or superimposed reinforcements can moreover be incorporated in the plastics or rubber sheets without any problems in the moulding processes employed.

The drawings illustrate the invention and in fact:

Figures 1 to 9 are cross-sections through cylinder head gaskets according to the invention in the zone adjacent a combustion chamber.

In Figures 1 to 4, 1 is a gasket or sealing plate made from a fluoropolymer. It contains the combustion chamber openings at 2 and a cooling water opening at 3 and, in the surrounding zones, the gasket 1 is increased in height at 4*a*, 4*b*, 4*c* and 5 by profiled projections formed thereon for balancing the distribution of the sealing pressure. In the gasket 1 in Figure 2, the profiled projection 4*b* contains an auxiliary depression 6 for increasing the deformability. In Figure 3, the bead-like projection 4*c* is compressed in the combustion chamber zone 2 by a flange 7. In Figure 4, the combustion chamber zone 2 is protected by an applied crimped or corrugated metal ring 8.

In Figure 5, the zones 9, 10 around the liquid opening 3 and around the combustion chamber opening 2 consist of a fluoropolymer, while the remaining area 11 is made from a normal butyl rubber.

In Figure 6, a sheet metal plate 12 is embedded in the gasket or sealing plate 1 and is doublecrimped or corrugated in the zone 2 adjacent the combustion chamber in accordance with the profile-like projections 4*b*.

In Figure 7, a double-crimped reinforcing ring 13 is embedded in the zone 2 adjacent the combustion chamber below the profile-like projections 4*b*.

In Figure 8, a reinforcing insert 14 consisting of a nonwoven fabric is embedded in the gasket or sealing plate 1, while the sealing edge 15 at the combustion chamber 2 has a concave shape, so that when the gasket is fitted this sealing edge is deformed into a straight line.

In Figure 9, two corrugated metal sheets 16 disposed one on top of the other are embedded in the gasket or sealing plate 1 for reinforcement, the hollow spaces of the metal sheets being free from polymer material. When the gasket is fitted, the metal sheets are deformed, so that a spring-back resilience moment is produced.

Claims

1. Cylinder head gasket for internal combustion engines consisting of a sheet of soft material with through openings for the combustion chambers, the lubricating oil, the coolant and the fixing bolts, characterised in that the cylinder head gasket (1) consists essentially of a polymeric material and is produced by a moulding process known from the plastics or rubber art.

2. Cylinder head gasket according to claim 1, characterised in that the cylinder head gasket (1) contains laminar reinforcing inserts (12, 13, 16, 14).

3. Cylinder head gasket according to claims 1 and 2, characterised in that the reinforcing inserts (16) have hollow spaces free from polymer.

4. Cylinder head gasket according to claims 1 to 3, characterised in that the reinforcing inserts (12, 13, 16) consist of metal sheets.

5. Cylinder head gasket according to claims 1 to 3, characterised in that the inserts (12, 13, 16) consist of plastics sheets.

6. Cylinder head gasket according to claims 1 to 3, characterised in that the reinforcing inserts (12, 13, 16) consist of non-woven fabrics (14).

7. Cylinder head gasket according to any one of claims 1 to 6, characterised in that the polymeric material contains reinforcing fibres.

8. Cylinder head gasket according to any one of claims 1 to 7, characterised in that it contains inserts (9, 10) of a polymer resistant to high temperatures and/or chemicals.

9. Cylinder head gasket according to any one of claims 1 to 8, characterised in that the inserts (9, 10) surround at least one of the through openings (2, 3) in annular form.

10. Cylinder head gasket according to any one of claims 1 to 9, characterised in that the inserts (9, 10) consist of metal and surround at least one of the through openings for the fixing bolts in annular form.

11. Cylinder head gasket according to any one of claims 1 to 10, characterised in that the metal inserts (9, 10) form the bridge zone between the through openings for the combustion chambers.

12. Cylinder head gasket according to any one of claims 1 to 11, characterised in that the inserts (9, 10, 13, 14, 16, 12) are polymerized in a mould together with the polymers by a process known from the rubber and plastics art.

13. Cylinder head gasket according to any one of claims 1 to 12, characterised in that the sealing surfaces thereof have profile-like projections (4) on one or both sides which are formed from the polymeric material by suitably shaping the moulding tools.

14. Cylinder head gasket according to any one of claims 1 to 13, characterised in that the profile-

like projections (4) are arranged in accordance with the particular specific structural conditions of the engines to be sealed.

15. Cylinder head gasket according to any one of claims 1 to 14, characterised in that the profile-like projections (4) are arranged in annular form around at least one of the through openings (2, 3).

16. Cylinder head gasket according to any one of claims 1 to 15, characterised in that the sealing surfaces (15) of at least one of the through openings (2, 3) is given a convex shape.

17. Cylinder head gasket according to any one of claims 1 to 16, characterised in that the gasket (1) is produced by an injection moulding process known *per se*.

18. Cylinder head gasket according to any one of claims 1 to 17, characterised in that the inserts (13) are arranged only in certain zones of the gasket (1).

19. Cylinder head gasket according to any one of claims 1 to 18, characterised in that the thickness of the reinforcing inserts (12, 13, 14, 16) is specifically adapted to the particular pressure coditions of the engine.

20. Cylinder head gasket according to any one of claims 1 to 19, characterised in that the inserts (12, 13, 14, 16) are profiled.

21. Cylinder head gasket according to any one of claims 1 to 20, characterised in that the sealing surfaces of the gasket (1) have superimposed layers or coatings on one or both sides.

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